SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

Year: B. Tech IV (Semester VII)

Subject Name: Modern Trends in AI-ML **Subject Code: BTEA19722**
Type of course: Honors

Prerequisite: Machine Learning, Deep Learning.

Rationale: Modern trends in Artificial Intelligence (AI) and Machine Learning (ML) is crucial due to rapid evolution in technology, transformative effects of AI-ML on various industries, informed decision making in business and organizations, integration with cutting-edge technologies and global collaboration. It is also essential for individuals, businesses, and society at large to harness the benefits of these technologies responsibly, stay competitive, and navigate the evolving landscape of artificial intelligence.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teach. Hrs.	% Weigh tage
1.	**Introduction to Soft Computing and Bayesian Deep Learning: Soft Computing:** Search techniques for tuning hyper-parameters of the model - Genetic algorithm, Particle Swarm optimization, Ant Colony Optimization. **Bayesian Deep Learning:** Introduction to Deep Learning and Bayesian Inference, Bayesian neural networks (BNNs), convolutional neural networks (BCNNs) and its applications.	10	25
2.	**Natural Language Processing (NLP):** Introduction to NLP; Preprocessing in NLP - Tokenization, Stemming, Lemmatization, Stop word removal, Unigram, Bigram, Ngram, Sentence segmentation; **Part of Speech Tagging** - Rule based POS Tagging, Properties of Rule Based POS Tagging, Stochastic POS Tagging, Properties of Stochastic POS Tagging, Transformation based Tagging, Hidden Markov Model	12	20

	(HMM) POS Tagging. **Word Sense Disambiguation** - Word embedding, Supervised Machine Learning Approach for WSD, Dictionary and Thesaurus Methods, Simplified Lesk Algorithm, WordNet and WordNet based similarity measures, Colocational features and Bag of word features.		
3.	**Generative AI** : Introduction, Large Language Model (LLM) - Language models and LLM architectures, BERT and its variants, GPT and its variants, Conversational AI, Sentiment Analysis. Image generation with GANs, Deepfake with GANs, Style transfer using GAN	10	25
4.	**Explainable AI (XAI)** : Introduction, Threats of advancement in AI/ML, Black Box v/s Glass Box Models, model agnostic v/s model specific Explainability with libraries, XAI for tabular and image data, Use Cases of XAI, challenges in achieving explainability, overview of Ethical and responsible AI.	8	20
5.	**Special Applications/Case Study:** AI in Agriculture, Autonomous vehicles, Healthcare, AI in Smart cities development, Robot Learning from Demonstration (LfD).	5	10

Suggested Specification Table of Marks as per Bloom's Taxonomy (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	20	25	25	10	5

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels.

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details	Year of publication	Publication Edition
1.	Dive into Deep Learning	Aston Zhang, Zachary C. Lipton, Alexander J. Smola	Cambridge University Press	2023	First
2.	Generative AI with Python and TensorFlow 2	Joseph Babcock, Raghav Bali	Packt	2023	First
3.	Explainable AI for Practitioners	Michael Munn, David Pitman	O'Reilly	2022	First

4.	Hands-on Natural Language Processing with Python	Rajesh Arumugam, Rajalingappaa Shanmugmani	Packt Publishing	2018	First
5.	Blueprints for Text Analytics Using Python: Machine Learning-Based Solutions for Common Real World (NLP) Applications	Jens Albrecht, Sidharth Ramachandran, Christian Winkler	O'Reilly	2021	First
6.	Artificial Intelligence (AI): Recent Trends and Applications	Suguna, S.K., Dhivya, M., & Paiva, S.	CRC Press.	2021	First
7.	Speech and Language Processing :An Introduction to Natural Language Processing, Speech Recognition, and Computational Linguistics	Daniel Jurafsky and James H. Martin	Prentice Hall	2009	Second edition

Course Outcome:

Sr. No.	CO Statement After learning this subject students will be able to,	Marks % weightage
CO-1	Understand Soft computing and Bayesian deep learning concepts for optimizing hyperparameters of machine learning models.	25
CO-2	Apply practical concepts of NLP, to address real-world problems.	25
CO-3	Analyze the performance LLM architectures in text generation, sentiment analysis, and conversational AI.	20
CO-4	Organize XAI techniques to analyze the predictions made by machine learning models.	20
CO-5	Create real time application in the AI-ML domain.	10

Mapping with POs:

Mapping with POs:	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO-1	3	3	3	3	2	2	2	1	2	2	3	3
CO-2	3	3	3	3	3	2	2	1	2	2	3	3
CO-3	2	3	3	3	3	2	2	0	0	2	2	2
CO-4	2	3	2	2	2	1	2	0	2	2	3	2
CO-5	2	2	3	3	3	2	2	1	3	3	2	2

List of Practical:

Sr. No.	Practical
1	Perform the following tasks of NLP on brown corpus using NLTK Toolkit • Tokenize into sentences and words • Stopwords • Collocations • Parts of speech identification • Stemming and lemmatization • Corpus
2	Identify the grammatical group (NOUN, PRONOUN, ADJECTIVE, VERB, ADVERBS) of a given sentence using POS Tagger
3	Implement Word2Vec embedding for BBC News dataset
4	Case Study for Building a Conversational Agent • IBM WATSON • Slack API
5	An optimization problem solving using Genetic Algorithm/PSO/ACO
6	Implementation BERT model
7	Image generation using GAN
8	Implement XAI technique LIME (Local Interpretable Model-agnostic Explanations) and SHAP (SHapley Additive exPlanations) for a Classification Dataset
9	Implement XAI technique LIME (Local Interpretable Model-agnostic Explanations) and SHAP (SHapley Additive exPlanations) for a Regression Dataset

List of Open learning website:

1. http://www.nltk.org

List of Open Source Software:

1. List of Open Source Software:
2. NLTK (Natural Language Toolkit)
3. PyTorch
4. Stanford Core NLP
5. Spacy
6. LIME
7. SHAP (SHapley Additive exPlanations)

List of MOOC (Massive Open Online Course):

- NLP: "Natural Language Processing with Deep Learning" by Stanford University on Coursera
- Generative AI: "Deep Generative Models" by Stanford University on Coursera
- Explainable AI (XAI): "Interpretable Machine Learning" by University of Washington on Coursera